Small Business Innovation Research/Small Business Tech Transfer

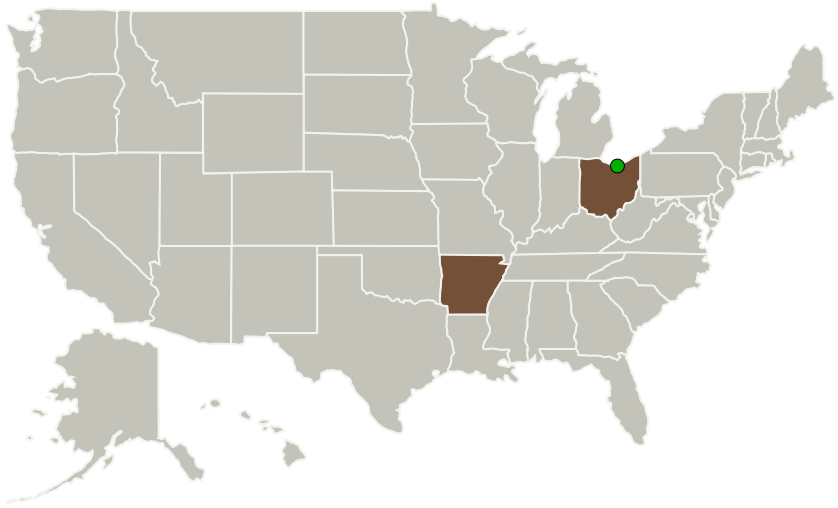
Extreme Environment SiC Wireless Sensor Suite for Nuclear Thermal Propulsion Engines, Phase II

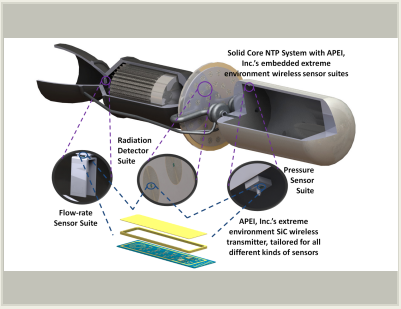
Completed Technology Project (2012 - 2015)

Project Introduction

There are a number of critical telemetry measurements to be monitored under continuous field operation, including temperature data across the reactor chamber and the nozzle, pressure data, neutron flux density and flow rate of the propellant. Real-time monitoring of this data in nuclear thermal engines would greatly improve operational safety and performance, reduce operational costs, and significantly impact maintenance costs and reliability. Even though some extreme environment sensors become available recently, it is still impossible to directly and accurately measure the critical operational parameters of NTP engines due to the lack of extreme environment electronics for those sensors. Data from extreme environment sensors is delivered via wire-line to an external actively cooled electronics box, where it is processed. This approach presents significant drawbacks such as the need for complex shielded wiring harnesses that not only are heavy but also limit sensor location and signal quality (i.e., signal to noise ratio). Additionally, these systems suffer from reliability issues due to wiring connections. In this Phase II SBIR, APEI, Inc. will build on the successful demonstration of high temperature wireless transmitter designs during Phase I, to deliver a set of SiC based, integrated wireless sensor-transmitter suites for extreme temperature operation (450 Deg C) in NTP engines. These sensor suites will allow for the real–time monitoring of critical engine components, reducing the risk of catastrophic failure and decreasing the inherent risk associated with NTP operation. The final wireless sensor systems will be fully integrated into an autonomous 'drop-in' solution for advanced sensing systems, including wireless energy harvesting.

Primary U.S. Work Locations and Key Partners





Extreme Environment SiC Wireless Sensor Suite for Nuclear Thermal Propulsion Engines Project Image

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Organizations Performing Work	Role	Type	Location
Arkansas Power Electronics International, Inc.	Lead Organization	Industry	Fayetteville, Arkansas
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Arkansas	Ohio

Project Transitions

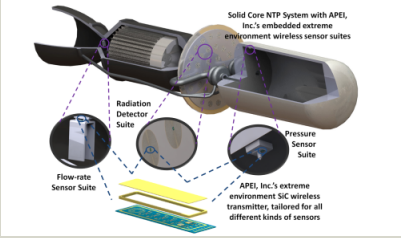
April 2012: Project Start

March 2015: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138070)*

Images



Project Image
Extreme Environment SiC Wireless Sensor Suite for Nuclear Thermal Propulsion Engines Project Image *(https://techport.nasa.gov/image/134008)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Arkansas Power Electronics International, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

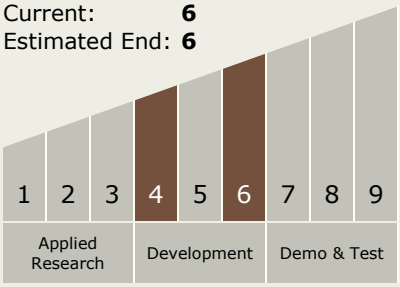
Carlos Torrez

Principal Investigator:

Jie Yang

Technology Maturity (TRL)

Start: **4**
Current: **6**
Estimated End: **6**



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Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.4 Advanced Propulsion
    - TX01.4.4 Other Advanced Propulsion Approaches

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System